SINKHOLE AND SINKHOLE AREA TREATMENT (Acre)

Standard (Interim)

Definition

A method of treating sinkholes and sinkhole areas to reduce contamination of ground water resources. (A sinkhole is a circular and funnel-shaped surface depression occurring in soluble bedrock areas and commonly develops as a result of surface soil moving downward into open bedrock fractures and solution cavities.)

Purpose

The primary purpose is to treat a source of ground water pollution by reducing the amount of contaminates or contaminated surface water entering sinkholes. A secondary benefit is improved farm safety with the closing of sinkhole entries.

Effect On Water Quality And Quantity

Improve ground water quality by removing contaminated materials from sinkholes and replacing direct inflow of contaminated surface water into sinkholes with land treatment methods that improve filtration and infiltration of surface water. Improved filtration and infiltration may provide some increase in soil moisture.

Conditions Where Practice Applies

On any land surface or existing practice where geologic conditions resulted in the development of sinkholes and where contaminated surface water and other contaminated material have the opportunity to enter sinkholes and pollute the ground water resource.

Planning Considerations

This practice includes the systems approach for solving the problem by treating both the sinkhole directly, and its drainage area (i.e. when possible, the practice should work in conjunction with the beneficial effects of existing or planned conservation cropping systems, pest and nutrient management and practices that control sheet, rill and gully erosion).

This treatment should be planned with consideration given to the following:

1. Land use.
2. Existing and planned land treatment.
3 Sinkhole drainage area.
4. Dimensions of sinkhole opening.
5. Safe outlet for diverted surface water.
6. Environmentally safe disposal site for sinkhole "clean out" material.
7. Availability and quality of inverted filter material.
8. Safety of equipment operators and laborers during practice installation.

Design Criteria

The type of treatment selected is based upon the size of the sinkhole drainage area and could include both direct sinkhole treatment alol1lg with surface water control measures and filter strips. The sinkhole treatment should not result in surface water ponding or high soil moisture conditions over an extended period of time. However, since percolation rates vary among different soils, ponding and soil moisture conditions may also vary.

The design for this treatment applies to sinkholes with excavated depths between 5 and 25 feet and with drainage areas up to 15 acres. (Most sinkholes can be excavated to 5 feet to allow for filter installation.) For sinkholes requiring excavated depths greater than 25 feet or uncontrolled drainage areas greater than 15 acres, adjustments to the inverted filter and/or surface water control

measure(s) may be required. In this case, geologic and engineering assistance must be requested and a site specific design prepared.

1. Treatment for sinkholes with drainage areas less than 5 acres

a. Treat sinkhole using Inverted Filter 1 specification and Figure 1.

(1) Inspection of the treatment should be made after periods of heavy runoff, since some material may run further into sinkhole voids causing a surface depression. In this case, maintenance will include adding soil material at the surface.

(2) The existing (or planned) land use or practice may exist over the treated sinkhole as long as the treatment is maintained

2. Treatment for sinkholes with drainage areas greater than 5 acres and using with a safe outlet for surface water control measure(s)

a. neat sinkhole using Inverted Filter 1 specification and Figure 1.

(1) Inspection of the treatment should be made after periods of heavy runoff, since some material may run further into sinkhole voids causing a surface depression. In this case, maintenance will include adding soil material at the surface.

(2) The existing (or planned) land use or practice may exist over the treated sinkhole as long as the treatment is maintained.

b. Install a surface water control measure to divert runoff away from the sinkhole to a safe outlet. *

(1) The measure should be located to reduce the internal drainage area around the sinkhole to less than 5 acres.

(2) The selected measure is based upon specific site conditions and the respective standard and specifications should be followed.

*****A safe outlet is one which does not: erode, divert surface water to another sinkhole, or cause flood damage to crops, property or buildings.

3. Treatment for sinkholes with drainage areas between 5 and 15 acres and no safe outlet available for surface water control measure(s)

a. Treat sinkhole using Inverted Filter 2 specification and Figure 2.

(1) Inspection of the treatment should be made after periods of heavy runoff, since some material may run further into sinkhole voids causing a surface depression. In this case, maintenance will include adding filter material at the surface.

(2) The treated sinkhole will remain as unused land

b. Install a filter strip around the sinkhole using orchard grass, bromegrass, reed canary grass or any other grass determined to have equivalent filtering and adsorption qualities.

(1) The filter strip is installed within the sinkhole drainage area and begins at the treated sinkhole. Its width (in feet) is determined by multiplying the sinkhole drainage area (acres) by seven.*

Since surface runoff may be temporarily stored behind the treated sinkhole, this width should provide beneficial filtering to exist for some distance outside the pool. This width determination is not consistent with Filter Strip Standard and Specification (393).

(2) For other installation and maintenance information, Filter Strip Standard and Specification (393) should be followed.

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Design and Check Data Requirements (Interim)

Basic Data

1. Drainage area of sinkhole.
2. Availability of safe outlet for surface water, if applicable.
3. Estimated depth and volume of sinkhole.

Design

1. Plan view showing sinkhole and, if applicable, any associated surface water control measure(s) and filter strip.
2. Drawing of inverted filter showing thickness of each filter material.
3. Determine the quantity of each filter material selected

Check Data

1. Seeding performed
2. Maintenance required after periods of heavy runoff.

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References (Interim)

1. *Estimating Runoff and Peak Discharges,* USDA-SCS, Engineering Field Manual, Chapter 2, August, 1987.

2. *Urban Hydrology for Small Watersheds,* USDA-SCS, Technical Release 55, June 1986.

3. *Graded Riprap Stone, Quarried Stone for Erosion and Sediment Control,* National Crushed Stone Association, June, 1978.

4. Specifications, Section 703--*Aggregates,* Publication 408, Department of Transportation, Commonwealth of Pennsylvania, 1987.

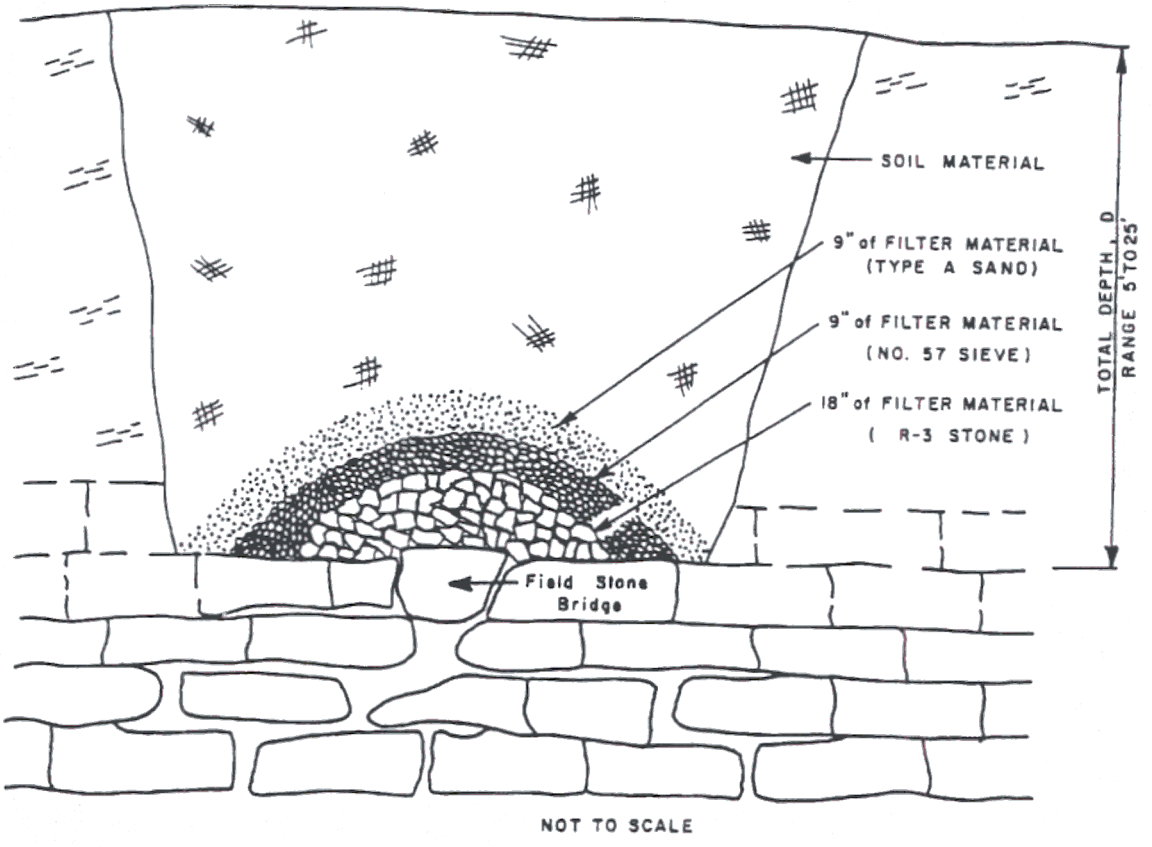
5. Koerner, R.M., *Designing With Geosynthetics,* Prentice-Hall, Englewood Cliffs, NJ, 1985.

6. *Engineering Geology,* USDA-SCS, National Engineering Handbook, Section 8, Chapter 1, 1978.

Other SCS Standards and Specifications that may apply with the installation of this practice include: Diversion (362), Filter Strip (393), Grassed Waterway (412), Lined Waterway or Outlet (468), Terrace (600) and Construction Specification 25.

SINKHOLE TREATMENT
(Drainage Area less than 5 Acres)

INVERTED FILTER I
Figure I



SINKHOLE TREATMENT
(Drainage Area 5 - 15 Acres)

INVERTED FILTER 2
Figure 2